UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

MAR 05 2018

Ms. Julie Crocker,
Acting Assistant Regional Administrator for Protected Resources
National Marine Fisheries Service
55 Great Republic Drive
Gloucester, MA 01930

Dear Ms. Crocker:

The U. S. Environmental Protection Agency (EPA) has reviewed the District of Columbia's (DC) proposed revised Water Quality Standards (WQS) for ammonia and cadmium. EPA wishes to enter informal consultation with National Marine Fisheries Service (NMFS) regarding this action. On September 15, 2017, the District Department of Energy and the Environment (DOEE) published the Notice of Proposed Rulemaking in the D.C. Register for public comment. DOEE is expected to respond to public comments and publish the new and revised regulations under Chapter 11 of Title 21 of the District of Columbia Municipal Regulations (DCMR) and submit to EPA within the coming months. Pursuant to EPA's authority outlined in 40 CFR 131.5, EPA must review and approve the final version of the DCWQS. Assuming that the final revisions to the WQS aquatic life criteria are consistent with the revisions published during the public comment period and evaluated in the attached enclosure, EPA requests concurrence from your office to confirm that the revisions may affect, but are not likely to adversely affect, any species listed as threatened or endangered, or their critical habitat, by NMFS under the Endangered Species Act of 1973, as amended. Our supporting analysis is provided in the attached enclosure.

We ask that you respond to this letter as soon as possible, but no later than 30 days upon receipt. We look forward to an early reply to this letter and a favorable response to your review of the information. Should you have any questions concerning this correspondence or the enclosure, please contact me, or Jillian Adair of my staff at (215) 814-5713 or adair.jillian@epa.gov.

Sincerely,

Evelyn S. MacKnight

Evelyn S. MacKnight, Associate Director
Water Protection Division

Enclosure
cc. Christine Vaccaro (NOAA)

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Biological Evaluation for the Approval of the District of Columbia 2016 Water Quality Standards Triennial Review

Evelyn MacKnight

Evelyn MacKnight, Associate Director
Water Protection Division

Date: 3/5/18

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Biological Evaluation for the Approval of the District of Columbia 2016 Water Quality Standards Triennial Review

Executive Summary

This Biological Evaluation (BE) assesses the effects which may occur to federally-listed threatened and endangered species as a result of the U.S. Environmental Protection Agency (EPA) approval of water quality standards (WQS) under the Clean Water Act (CWA) adopted by the District of Columbia (DC). The specific focus of this evaluation is EPA approval of WQS for the protection of aquatic life, including a chronic and acute criterion for both ammonia and cadmium. These criteria represent revisions to previously approved ammonia and cadmium criteria and are more scientifically-defensible due to the addition of previously unavailable organismal toxicity data.

EPA has found that the approved criteria for ammonia and cadmium will be insignificant and/or discountable to listed species and these provisions are not likely to adversely affect the listed species or their associated critical habitat. Ammonia and cadmium at levels allowed under DC's chronic and acute criteria elements are not a major threat to the listed species in DC: Shortnose Sturgeon (*Acipenser brevirostrum*) and Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*), or the Atlantic Sturgeon critical habitat.

Description of the Proposed Action

Endangered Species Act (ESA)

Federally protected species are listed as endangered or threatened under the Endangered Species Act of 1973, as amended, 16 U.S.C. Section 1536, and its implementing regulations, 50 C.F.R. Part 402. Section 7(a) of the ESA grants authority to, and imposes requirements upon, federal agencies regarding endangered or threatened species of fish, wildlife, or plants ("listed species") and habitat of such species that have been designated as critical ("critical habitat"). The ESA requires every federal agency, in consultation with the Secretary of Interior, to ensure that any action it authorizes, funds, or carries out, in the United States or upon the high seas, is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. The United States Fish and Wildlife Service (USFWS) administers Section 7 consultations for freshwater species, while the United States National Marine Fisheries Service (NMFS) administers Section 7 consultations for marine species and anadromous fish. This BE represents an effort by EPA to informally consult with NMFS regarding the EPA approval action of DC WQS, which may affect listed species and their critical habitat.

EPA's WQS Program

A WQS defines the water quality goals for a waterbody by designating the use or uses of the water, by setting criteria necessary to protect the uses, and by preventing or limiting degradation of water quality through anti-degradation provisions. Under Section 303(c) of the CWA and 40 C.F.R. 131, States and authorized tribes have primary responsibility to develop and adopt water quality standards to protect their waters. In addition to adopting WQS, states are required to review those standards every three years and then revise the standards, as necessary. This public process, commonly referred to as the "Triennial Review", allows for new technical and scientific data to be considered in order to update the standards. The EPA then reviews and approves/disapproves of new and revised WQS that have been adopted by States and authorized tribes. State WQS are not considered effective under the CWA until approved by EPA.

Unlike other EPA actions that may introduce a pollutant into the environment, approval of a WQS limits the allowable level of a pollutant that, in the absence of the standard, would be unlimited. As an analytical simplification, this BE protocol considers whether the criterion at issue is sufficiently stringent so that listed species would be protected. This federal action neither authorizes the introduction of a pollutant into the environment nor represents a plan to authorize any such introduction so long as the criterion is not exceeded.

DC's WQS Triennial Review

The District Department of Energy and the Environment (DOEE) has conducted its Triennial Review of DCWQS as required by Section 303(c) of the CWA and DC's Water Pollution Control Act of 1984. On September 15, 2017, DOEE published the Notice of Proposed Rulemaking in the D.C. Register and on October 26, 2017, DOEE conducted a public hearing to solicit comments on the rulemaking. DOEE is expected to respond to public comments and publish the new and revised regulations under Chapter 11 of Title 21 of the District of Columbia Municipal Regulations (DCMR) within the coming months. Pursuant to EPA's authority outlined in 40 C.F.R. 131.5, EPA must review and approve the final version of the revised DCWQS submitted to EPA. Assuming that the revisions to the aquatic life criteria, including those revisions to ammonia and cadmium described below, are consistent with the revisions submitted to EPA during the public comment period and evaluated below, EPA requests concurrence from the Services to confirm that the revisions are not likely to adversely affect listed species or their critical habitat. If revisions to the aquatic life criteria significantly differ from what was published during the public comment period and evaluated below, EPA will resubmit another BE for informal consultation.

The Federal action being evaluated under ESA, Section 7 is the approval by EPA of the new and revised provisions regarding the protection of aquatic life. Although numerous provisions in DCWQS were adopted or revised during this triennial review, only those criteria regarding the protection of aquatic life will be evaluated under ESA, Section 7 as these revisions may potentially impact listed species in DC. Specifically, this BE addresses revisions to the ammonia and cadmium criteria. These standards are adopted and implemented to maintain and protect the waters of DC, and they provide for the propagation and protection of aquatically-dependent listed species. The WQS revisions discussed below take into account the best available science, including local and regional information, as well as applicable EPA policies, guidance, and legal requirements, to protect aquatic life.

EPA's 304(a) Nationally Recommended Criteria

Section 304(a) of the CWA authorizes the EPA to develop and revise recommended criteria for specific pollutants reflecting the latest scientific knowledge. These criteria documents provide justification for water quality criteria, including comprehensive literature reviews and toxicological analyses. In 2013, EPA published revised recommended criteria for ammonia and in 2016, EPA published revised recommended criteria for cadmium, both of which are for the protection of aquatic life. The updated criteria are reflective of new toxicity data, which were unavailable during past updates. The criteria are intended to be protective of aquatic life, including federally-listed endangered and threatened species. DC proposed to adopt EPA's recommended criteria for ammonia and cadmium; therefore, EPA's criteria documents are used throughout this BE to evaluate the potential effects of DC's WQS revisions on listed species (U.S.EPA 2013, U.S.EPA 2016).

The Ammonia Criteria

Ammonia is one of several forms of nitrogen that exist in aquatic environments and is considered one of the most important pollutants not only because of its highly toxic nature, but also its ubiquity in surface water systems (Russo 1985). The agricultural industry uses approximately 90% of the U.S. annual domestic ammonia production for fertilizer (USGS 2004). Ammonia also has numerous industrial applications, including use in metal finishing and treating applications (e.g., nitriding; Appl 1999), in the chemical industry for the production of pharmaceuticals (Karolyi 1968) and dyes (Appl 1999), in the petroleum industry for processing of crude oil and in corrosion protection, and in the mining industry for metals extraction (U.S. EPA 2004). Natural sources of ammonia include the decomposition or breakdown of organic waste matter, gas exchange with the atmosphere, forest fires, animal waste, the discharge of ammonia by aquatic biota, and nitrogen fixation processes (Environment Canada 1997; Geadah 1985).

Ammonia can enter the aquatic environment via anthropogenic sources, such as municipal effluent discharges and agricultural runoff, and natural sources, such as nitrogen fixation and the excretion of nitrogenous wastes from animals. In 2011, there were approximately 4.7 million pounds (lbs.) of ammonia documented as discharged from all reporting industries to surface waters (U.S. EPA 2011).

Ammonia is unique among regulated pollutants because it is a toxicant that organisms have developed various strategies to excrete. When ammonia is present in water at high enough levels, it is difficult for aquatic organisms to sufficiently excrete the toxicant, leading to toxic buildup in internal tissues and blood, and potentially death. The toxic action of ammonia on aquatic animals, particularly in sensitive fish, may be due to one or more of the following causes: (1) proliferation in gill tissues, increased ventilation rates and damage to the gill epithelium (Lang et al. 1987); (2) reduction in blood oxygen-carrying capacity due to progressive acidosis (Russo 1985); (3) uncoupling oxidative phosphorylation causing inhibition of production and depletion of adenosine triphosphate in the brain (Camargo and Alonso 2006); (4) and the disruption of osmoregulatory and circulatory activity disrupting normal metabolic functioning of the liver and kidneys (Arillo et. al.1981; Tomasso et al. 1980).

Among invertebrates, studies testing ammonia toxicity to bivalves, and particularly studies with freshwater mussels in the family Unionidae, have demonstrated their sensitivity to ammonia (Augspurger et al. 2003; Wang et al. 2007a, b; Wang et al. 2008). Toxic effects of unionized ammonia to both freshwater and marine bivalves include reduced opening of valves for respiration and feeding (Epifanio and Srna 1975); impaired secretion of the byssus, or anchoring threads in bivalves (Reddy and Menon 1979); reduced ciliary action in bivalves (U.S. EPA 1985); depletion of lipid and carbohydrate stores leading to metabolic alteration (Chetty and Indira 1995) as well as mortality (Goudreau et al. 1993). These negative physiological effects may lead to reductions in feeding, fecundity, and survivorship, resulting in decreased bivalve populations (Alonso and Camargo 2004; Constable et al. 2003).

In 2013, EPA revised and published recommended aquatic life criteria for ammonia in freshwaters based on EPA's latest scientific studies and toxicity data from over 69 aquatic genera including fish, invertebrate, and amphibian species, of which 12 are federally-listed as endangered, threatened, or a species of concern (U.S.EPA 2013). The 2013 document, which represents a revision of the 1999 recommended aquatic life criteria for ammonia, incorporates additional toxicity data for several sensitive freshwater mussel species. EPA's research suggests that freshwater mussels and gill-breathing snails are generally more sensitive to ammonia as compared to other aquatic life, such as fish and other invertebrates. The acute ammonia criterion is pH and temperature dependent, with invertebrates being more sensitive at higher temperatures (e.g., > 16 °C) and fishes in the genus *Oncorhynchus* being the most sensitive organisms at lower temperatures. Because *Oncorhynchus* fishes are not present in DC waters, DC proposed to adopt the version of EPA's recommended criteria that does not factor in *Oncorhynchus* sensitivity. The chronic ammonia criterion is also pH and temperature dependent, but does not differ based on the presence of fishes in the genus *Oncorhynchus*. DC adopted EPA's recommended criteria, which represent the latest scientific knowledge regarding ammonia toxicity on aquatic life.

The ammonia criteria are defined by a magnitude, duration, and frequency. The magnitude is the maximum pollutant concentration allowable, the duration is the time period in which the magnitude is averaged, and the frequency is the allowable number of times the pollutant concentrations can exceed the magnitude during a recurrence interval. It is important to note that analysis of the criteria magnitude has been the primary focus of previous BEs. Critical aspects of the criteria, including the duration and frequency, provide a high level of additional conservatism and protectiveness to the criteria overall. The magnitude of the ammonia criteria is represented as acute and chronic concentrations and are expressed as functions of temperature and pH of the receiving waterbody. The criteria document describes the relationship between ammonia and these water quality factors. For example, at a pH of 7 and temperature of 20°C, the 2013 acute criterion is 17 mg TAN/L and the chronic criterion is 1.9 mg TAN/L. In addition, the proposed criteria include a duration requirement that the highest four-day average within the same 30-day period used to determine compliance with the chronic criterion shall not exceed 2.5 times the chronic criterion and a one-hour average may not exceed the acute criterion. A frequency requirement states that the criteria are not to be exceeded more than once every three years.

Acute measures of effect used for aquatic organisms to develop the ammonia criteria are the lethal concentration (LC) 50 and effective concentration (EC) 50. LC is the concentration of a chemical that is estimated to kill the noted percentage of the test organisms. EC is the concentration of a chemical that is estimated to affect growth, survival, and/or reproduction in the noted percentage of the test organisms. These concentrations are then normalized to a pH of 7.0 (for all organisms) and temperature of 20°C (for invertebrates). The pH and temperature conditions to which these data are normalized were deemed to be generally representative of ambient surface water. These normalized values were then used to rank genus mean acute values (GMAV) calculated from combined species mean acute values (SMAVs) within each genus. A final acute value (FAV) is then determined by regression analysis using a log-triangular fit based on the four most sensitive GMAVs in the data set to interpolate or extrapolate (as appropriate) to the 5th percentile of the distribution represented by the tested genera. If there are 59 or more GMAVs, as is the case with ammonia, the four GMAVs closest to the 5th percentile of the distribution are used to calculate the FAV. Finally, the FAV is divided by two to calculate the acute criterion as per the 1985 guidelines (Stephan et al. 1985). The FAV divided by two approach was developed to estimate minimal effect levels, those which approximate control mortality limits, and is based on the analysis of 219 acute toxicity tests for a range of chemicals, as described in the Federal Register on May 18, 1978 (43 FR 21506-18). Ammonia acute toxicity data were available for 44 species of fish, 52 invertebrates, and four amphibians, including 12 species federally-listed as endangered, threatened, or species of concern.

Chronic measures of effect used for aquatic organisms to develop the ammonia criteria are EC20, no-observed-effect-concentrations (NOEC), lowest-observed-effect-concentrations (LOEC), and maximum acceptable toxicant concentration (MATC). EC20 values were used to estimate a low level of effect observed in chronic datasets that are available for ammonia (see U.S. EPA 1999). The NOEC is the highest test concentration at which none of the observed effects are statistically different from the control. The LOEC is the lowest test concentration at which observed effects are found to be statistically different from the control. The MATC is the calculated geometric mean of the NOEC and LOEC. All chronic data in individual studies were analyzed using regression analysis to demonstrate the presence of a concentration-effect relationship within the test. For those studies that demonstrated a concentration-effect relationship, EPA used regression analysis to estimate the EC20. These values were then used to rank genus mean chronic values (GMCV) calculated from combined species mean chronic values (SMCVs) within each genus. EPA calculated the chronic criterion as the final chronic value (FCV) based on the fifth percentile of the GMCVs. The four lowest values were used to calculate the FCV because values for fewer than 59 genera exist. Ammonia chronic toxicity data are available for 21 species of freshwater organisms: ten invertebrate species (mussels, clam, snail, cladocerans, daphnid, and insect) and 11 fish species, including three Federally-listed salmonids.

The acute and chronic ammonia toxicity data used to develop the acute and chronic criteria for ammonia in freshwater were collected via literature searches of EPA's ECOTOX database, EPA's Ambient Aquatic Life Water Quality Criteria for Ammonia (U.S. EPA 1985, 1998, 1999), data provided by the U.S. Fish and Wildlife Service and the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (collectively known as the Services), and EPA regional and field offices. All available, reliable acute and chronic toxicity values published since 1985 were incorporated into the appropriate ammonia tables and used to recalculate the acute and the chronic criterion, as outlined in detail in the 1985 Guidelines. The most recent literature search covered the period from 1985 through October 2012.

The Cadmium Criteria

Cadmium is a relatively rare, naturally occurring metal found in mineral deposits and distributed widely at low concentrations in the environment. Cadmium is used by industry to manufacture batteries, pigments, plastic stabilizers, metal coatings, alloys, electronics, and nanoparticles for use in solar cells and color displays. These anthropogenic sources are responsible for over 90 percent of the cadmium found in surface waters. Upon entering aquatic environments, majority of cadmium becomes strongly adsorbed to sediments, removed from the water column, and often not bioavailable to organisms.

Cadmium is a non-essential metal with no biological function in aquatic animals (Eisler 1985; Lee et al. 1995; McGeer et al. 2012; Price and Morel 1990; Shanker 2008). In one study comparing the acute toxicity of all 63 atomically stable heavy metals in the periodic table, cadmium was found to be the most acutely toxic metal to the amphipod, *Hyalella azteca*, based on the results of seven-day acute aquatic toxicity tests (Borgmann et al. 2005). In addition to acute toxicity, cadmium is a known teratogen and carcinogen, is a probable mutagen and is known to induce a variety of other short- and long-term adverse physiological effects in fish and wildlife at both the cellular and whole-animal level (Eisler 1985; Okocha and Adedeji 2011). Chronic exposure leads to adverse effects on growth, reproduction, immune and endocrine systems, development, and behavior in aquatic organisms (McGeer et al. 2012). Other toxic effects include histopathologies of the gill, liver and kidney in fish, renal tubular damage, alterations of free radical production and the antioxidant defense system, immunosuppression, and structural effects on invertebrate gills (Giari et al. 2007; Jarup et al. 1998; McGeer et al. 2011; Okocha and Adedeji 2011; Shanker 2008). Cadmium can bioaccumulate in aquatic organisms, with total uptake depending on the environmental cadmium concentration, exposure route and the duration of exposure (Annabi et al. 2013; Francis et al. 2004; McGeer et al. 2000; Roméo et al. 1999).

Toxic effects are thought to result from the free ionic form of cadmium (Goyer et al. 1989), which causes acute and chronic toxicity in aquatic organisms primarily by disrupting calcium homeostasis and causing oxidative damage. In freshwater fish, cadmium competes with calcium at high affinity binding sites in the gill membrane and blocks the uptake of calcium from water by interfering with ion uptake in specialized calcium channels that are located in the mitochondria-rich chloride cells (Carroll et al. 1979; Evans 1987; McGeer et al. 2012; Morel and Hering 1993; Pagenkopf 1983; Tan and Wang 2009). The combined effect of competition for the binding sites and blockage of calcium uptake on the gill membrane results in acute hypocalcaemia in freshwater fish, which is characterized by cadmium accumulation in tissues as well as decreased calcium concentrations in plasma (McGeer et al. 2011; Roch and Maly 1979; Wood et al. 1997).

In 2016, EPA revised and published recommended aquatic life criteria for cadmium (U.S. EPA, 2016). The revised criteria represent an update to EPA's 2001 cadmium criteria and include additional aquatic life toxicity tests on 75 new species, nine of which are federally-listed as endangered or threatened, and 49 new genera published since 2001. DC adopted EPA's recommended criteria, which represent the latest scientific knowledge regarding cadmium toxicity on aquatic life.

Like ammonia, the cadmium criteria are defined by a magnitude, duration, and frequency. The magnitude of the cadmium criteria is represented as acute and chronic concentrations and are expressed as a function of hardness of the receiving waterbody. The criteria document describes the relationship between cadmium and hardness. For example, at a total hardness of 100 mg/L as $CaCO_3$, the acute criterion is 1.8 μg/L and the chronic criterion is 0.72 μg/L. In addition, the proposed criteria include a duration requirement that the acute criterion not be exceeded over a one-hour average and a chronic criterion not be exceeded over a four-day average. A frequency requirement states that the criteria are not to be exceeded more than once every three years.

The acute measures of effect used for aquatic organisms to develop the cadmium criteria are the LC50, EC50, and Inhibitory concentration (IC) 50. IC is the concentration of a chemical that is estimated to inhibit some biological process (e.g., growth) in the noted percentage of the test organisms. These concentrations are then normalized with a hardness of 100 mg/L $CaCO_3$. The hardness conditions to which these data are normalized were deemed to be generally representative of ambient surface water. These normalized values were then used to rank genus mean acute values (GMAV) calculated from combined species mean acute values (SMAVs) within each genus. A final acute value (FAV) is then determined by regression analysis using a log-triangular fit based on the four most sensitive GMAVs in the data set to interpolate or extrapolate (as appropriate) to the 5th percentile of the distribution represented by the tested genera. As per the 1985 guidelines and because the SMAV for the commercially and recreationally important rainbow trout was lower than the calculated FAV, the final FAV was lowered to protect the species. Finally, the FAV is divided by two to calculate the acute criterion. Cadmium acute toxicity data are available for 101 species and 75 genera of invertebrates, fish, and amphibians, of which nine species are federally-listed as endangered, threatened, or a species of concern.

The chronic measures of effect used for aquatic organisms to develop the cadmium criteria are the EC20, NOEC, and LOEC. EPA selected an EC20 to estimate a low level of effect that would be statistically different from control effects, but not severe enough to cause chronic effects at the population level (see U.S. EPA 1999a). Reported NOECs and LOECs were only used for the derivation of chronic criterion when an EC20 could not be calculated for the genus. When LOECs and NOECs are used, a MATC is calculated. These concentrations were normalized to a hardness of 100 mg/L $CaCO_3$. The values were then used to rank GMCVs calculated from combined SMCVs within each genus. EPA calculated the chronic criterion as the FCV based on the fifth percentile of the GMCVs. The four lowest values were used to calculate the FCV because values for fewer than 59 genera exist. Cadmium chronic toxicity data are available for 27 species representing 20 genera, of which four species are federally-listed as endangered, threatened, or a species of concern.

During CWA Section 304(a) criteria development, EPA reviews and considers all relevant toxicity test data. Information available for all relevant species and genera are reviewed to identify: 1) data from acceptable tests that meet data quality standards; and 2) whether the acceptable data meet the minimum data requirements (MDRs) as outlined in EPA's 1985 Guidelines (Stephan et al. 1985; U.S. EPA 1986). The taxa represented by the different MDR groups represent taxa with different ecological, trophic, taxonomic and functional characteristics in aquatic ecosystems, and are intended to be a representative subset of the diversity within a typical aquatic community.

Action Area

The action area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR Section 402.02). This includes the project's footprint as well as the area beyond it that may experience direct or indirect effects that would not occur but for the action. The revised ammonia and cadmium criteria apply to all surface, freshwaters of the United States within DC under Federal jurisdiction. Waters of DC are defined as flowing and still bodies of water, whether artificial or natural, whether underground or on land, so long as in the DC, but excluding waters on private property prevented from reaching underground or land watercourses, and also excluding water in closed collection or distribution systems. Waters in DC include the Potomac River, Anacostia River, Rock Creek, and associated tributaries. These areas represent the extent of the action area.

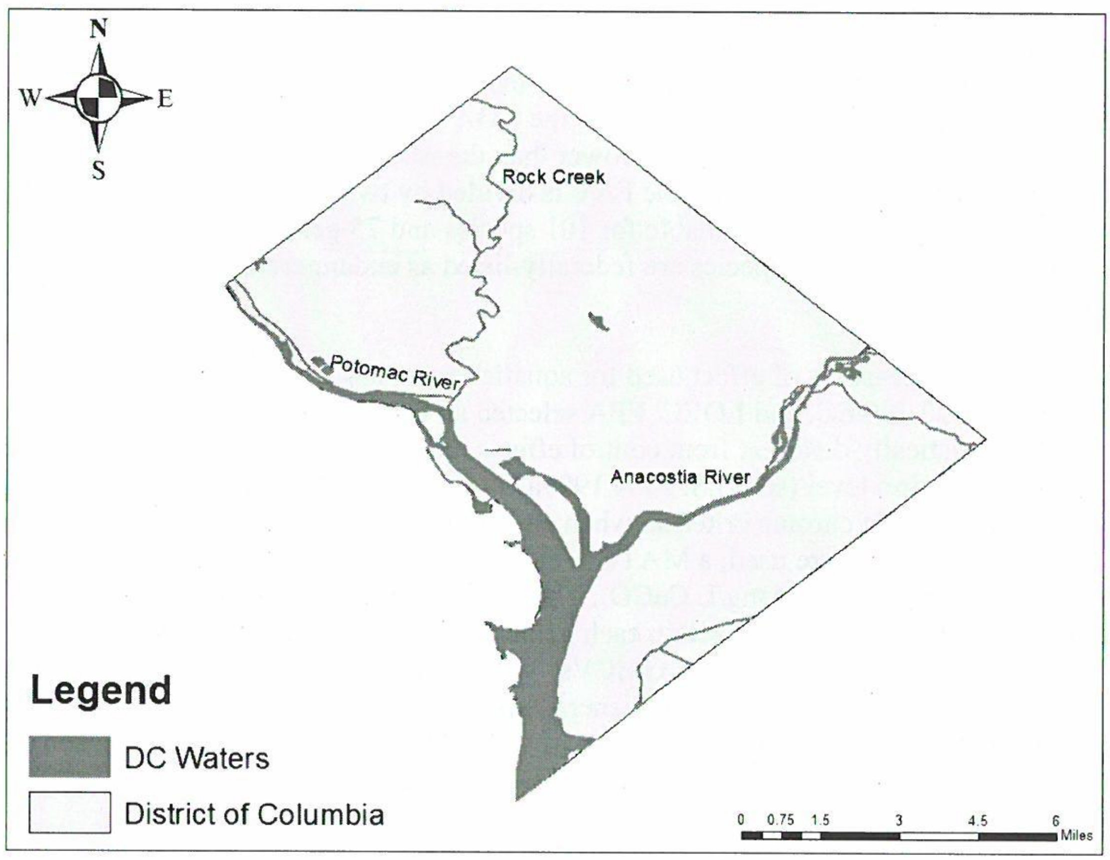

Figure 1: DC and waterways

Listed Species and Critical Habitat within the Action Area

Species that have more than a limited exposure to water are considered either aquatic or aquatic-dependent and, as such, are subject to consultation. Per the direction of NMFS (Chris Vaccaro, Fishery Biologist, GARFO), EPA has included all marine and anadromous federally endangered and/or threatened species within the DC region. EPA has determined that based on the overlapping action area with species ranges, the following species and associated critical habitat may be affected by EPA's approval of DC's WQS revisions:

Shortnose Sturgeon

The shortnose sturgeon (*Acipenser brevirostrum*), which has been federally listed as endangered since March 11, 1967, is one of the species under NMFS's jurisdiction that may occur within the action area in the Potomac and Anacostia Rivers and Rock Creek. Shortnose sturgeon are a large, long lived, benthic fish species (U.S. NMFS, 2010). They are anadromous, living mainly in slower moving riverine waters or nearshore marine waters, and migrating periodically into faster moving freshwater areas to spawn. Shortnose sturgeon mainly occupy the deep channel sections of large rivers, but will forage where food is accessible. They feed on a variety of benthic and epibenthic invertebrates including mollusks, crustaceans (amphipods, chironomids, isopods), and oligochaete worms in soft-sediment habitat (Dadswell 1979). Shortnose sturgeon are opportunistic foragers, and will forage where appropriate prey items are located.

Shortnose sturgeon populations range from the St. Johns River in Florida to the Saint John River in New Brunswick, Canada. Shortnose sturgeon are known to occur in the Chesapeake Bay, although the current abundance is unknown and there is limited data available regarding distribution, foraging and overwintering in the Bay. However, in general, shortnose sturgeon typically occur in the deepest parts of rivers or estuaries where suitable dissolved oxygen and salinity values are present (Gilbert 1989). Deep water may also serve as thermal refugia from the temperatures that occur seasonally at the surface and in shallower habitat.

A sturgeon reward program was enacted in 1996 and was aimed at collecting data on Atlantic sturgeon incidentally caught in commercial fisheries in the Bay (Litwiler 2001; Welsh et al. 2002). In the first year of the program, two shortnose sturgeons were captured and identified. As of November 30, 2008, a total of 80 individual shortnose sturgeon have been captured in the Chesapeake Bay and its tributaries; an additional three were recaptures. Most of the shortnose sturgeon documented in the reward program have been caught in the upper Bay, from Kent Island to the mouth of the Susquehanna River and the C&D Canal; in Fishing Bay and around Hoopers Island in the middle Bay; and in the Potomac River towards the south. Specific to the Potomac River, the reward program documented six individuals at the mouth of the Potomac River, one at the mouth of the St. Mary's River, one at the mouth of the Potomac Creek, and three individuals within the Potomac River (one at rkm 63, rkm 57 and rkm 48 respectively).

A tagging and telemetry study depicted the range of shortnose sturgeon to extend from the Little Falls area to the confluence of the Potomac River with the Chesapeake Bay (U.S. FWS

2009). The study, conducted by the U.S. Geological Survey (USGS) and USFWS, concluded in 2007. This study demonstrated that there was adequate habitat for shortnose sturgeon to forage, winter and spawn in the Potomac River. CART (combined acoustic and radio transmitting) tags were applied to two shortnose sturgeon during the study and one additional shortnose sturgeon in 2008 after the completion of the study. The fish tagged in 2008 has not been detected by telemetry array within the Potomac River; this suggests that the fish either shed the tag, left the Potomac, was caught, or died.

During the study, USFWS sampled for adult shortnose sturgeon using gill nets. In 2005, only one adult—an egg-bearing female—was captured. A second egg-bearing adult female was captured in 2006 by a commercial fisherman. Both fish were tagged with CART tags to track their movements. Despite using the movements of the tracked fish to guide intensive netting efforts, the study investigators recorded minimal findings. The lack of specimens seems to indicate that the species is less abundant in the Potomac River than in other rivers known to have a sustaining population of shortnose sturgeon. The study concluded that a female shortnose sturgeon tagged in 2005 appears to be a year-round resident of the Mattawoman Creek in Maryland, approximately 20 miles downstream of the District. In April, 2007 a female that had been tagged in 2006 was tracked to a potential spawning area near the District where she remained for nearly a week; however, there was no evidence that this female released any eggs at that time. In April 2009, the same female spent 11 days traveling upstream in the Potomac River from Cole's Point in Virginia (river km 35, downstream of the District), to Chain Bridge (river km 187). There is no evidence that she spawned in the two days she remained in the presumed spawning ground.

In another study, sonic tags were attached to 13 shortnose sturgeon captured in the reward program from the upper Chesapeake Bay and to 26 shortnose sturgeon captured near Scudders Falls in the Delaware River to see if tagged fish used the Chesapeake and Delaware (C&D) Canal (Welsh et al. 2002). Three of the 13 fish tagged in the Chesapeake Bay were later relocated in the C&D Canal or the Delaware River. This study confirmed the use of the C&D Canal by Chesapeake Bay fish. Researchers have theorized that shortnose sturgeons were extirpated from the Potomac/Chesapeake Bay before the time they were first listed as an endangered species in 1967. Many believe that the present day population of shortnose sturgeon found in the Bay and its tributaries are colonizers from the Delaware River via the C&D Canal. This theory is supported by the tagging data showing use of the C&D Canal and from recent genetic work using mtDNA (Grunwald et al. 2002, Wirgin et al. 2005) and microsatellite DNA analysis.

There are major data gaps regarding tracking and tagging shortnose sturgeon in the Chesapeake Bay area. This is due to a variety of factors, including low population numbers in the area, tag deficiencies, technology failures and the lack of completed studies. It is also worth noting that EPA has no information showing that shortnose sturgeon have ever been documented in the Anacostia River, Rock Creek, Tidal Basin or the Washington Ship Channel. Records for the Anacostia River and Rock Creek further suggest that habitats in these waterbodies and their tributaries are not consistent with the aquatic environment known to support shortnose sturgeon.

However, suitable spawning habitat exists within the tributaries of the Chesapeake Bay. Research on other shortnose sturgeon populations indicates that this species typically spawns just below the limit of upstream passage, often the fall line (Kynard 1997). Several Chesapeake Bay tributaries, such as the Potomac River, have habitat characteristics such as cobble/gravel substrate and areas of high flow that may be suitable for spawning. Historical information on the habitat of the shortnose sturgeon suggests that the species is typically found in the deepest areas of the Potomac River, specifically in the River's deep water navigation channel. Foraging generally occurs in somewhat shallower conditions over mud flats of shellfish beds with submerged aquatic vegetation. Type of habitat does not change based on season, with the majority of time being spent in the channel or channel edge, within water depths of 7.0-21.3 meters (NOAA, Kurkul). Adult shortnose sturgeon have been documented in the Potomac River (Kynard et al. 1997; Kynard et al. 2009) up to the Little Falls Dam. Foraging is assumed to occur mainly in the deepwater channel. Other life stages are assumed, but currently unknown. Spawning has historically occurred in the Potomac River, but current spawning is only assumed based on the presence of pre-spawning females and suitable habitat. Rearing is expected to occur in the Potomac due to the presence of eggs, which would presumably hatch and allow the larvae to be present downstream in freshwater. Based on assumed and documented presence, EPA has considered all life stages of shortnose sturgeon in our approval of the water quality criteria.

Atlantic Sturgeon

Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) are long-lived (approximately 60 years), late maturing, estuarine dependent, anadromous fish (U.S. NMFS, 2007; Bigelow and Schroeder 1953; Vladykov and Greeley 1963; Mangin 1964; Dadswell 2006). Diets of adult and migrant subadult Atlantic sturgeon include mollusks, gastropods, amphipods, annelids, decapods, isopods, and fish such as sand lance (Bigelow and Schroeder 1953; Savoy and Pacileo 2003). Juvenile Atlantic sturgeon feed on aquatic insects, insect larvae, and other invertebrates (Bigelow and Schroeder 1953).

Atlantic sturgeon originating from the New York Bight, Chesapeake Bay, Carolina, and South Atlantic Distinct Population Segments (DPS) are listed as endangered, while those from the Gulf of Maine DPSs are listed as threatened (77 FR 5880 and 77 FR 5914; February 6, 2012). The Chesapeake Bay DPS, which includes areas of the Potomac and Anacostia Rivers in DC, was listed as endangered on February 6, 2012 (NOAA website). The marine range of all five DPSs extends along the Atlantic coast of North America from Canada to Cape Canaveral, Florida. Atlantic sturgeon spawn in their natal river, with spawning migrations generally occurring during February-March in southern systems, April-May in Mid-Atlantic systems, and May-July in Canadian systems (Murawski and Pacheco 1977; Smith 1985; Bain 1997; Smith and Clugston 1997; Caron et al. 2002). Young remain in the river/estuary until approximately age 2 before emigrating to the open ocean as subadults (Dovel and Berggen 1983; Dadswell 2006). After emigration from the natal river/estuary, subadults and adult Atlantic sturgeon travel within the marine environment, in waters up to approximately 164 feet in depth, using coastal bays, sounds, and marine waters (Vladykov and Greeley 1963; Murawski and Pacheco 1977; Dovel and Berggren 1983; Smith 1985; Collins and Smith 1997; Welsh et al. 2002; Savoy and Pacileo 2003; Stein et al. 2004). Dadswell et al. (1984) indicated that shortnose sturgeon typically occur in waters no shallower than 3.3 feet. While few studies exist on the depth preferences of Atlantic sturgeon, because of similar observed habitat requirements and biology between shortnose and Atlantic sturgeon, it is expected that this observation is accurate for both species.

Based on the best available information, Atlantic sturgeon originating from any of the five DPSs could occur in the area near the confluence of the Potomac River and Chesapeake Bay and up to Little Falls Dam while in search of suitable foraging habitat. Juveniles, subadults, adults, and potentially eggs, larvae, and young of year may be present within the Potomac River as spawning, rearing, and foraging all potentially occur. Three small juveniles and a large mature female have been captured in the Potomac River and due to the presence of features necessary to support reproduction and recruitment, the River potentially supports both spawning and rearing. Additionally, the distribution of Atlantic sturgeon from any DPS is strongly associated with prey availability and, as a result, Atlantic sturgeon in juvenile, subadult, and adult life stages may occur where suitable forage (e.g., benthic invertebrates such as mollusks and crustaceans) and appropriate habitat conditions (e.g., areas of submerged aquatic vegetation) are present within the Potomac River. Additionally, adult and subadult Atlantic sturgeon could use the Anacostia River for opportunistic foraging. Atlantic sturgeons also tend to be at least as tolerant of turbid estuarine and river conditions as other anadromous fish, such as striped bass. Dadswell et al. (1984) reported that sturgeons are more active under lowered light conditions, such as those in turbid waters.

Critical Habitat of the Atlantic Sturgeon

The ESA authorizes USFWS and NMFS to designate critical habitat for federally-listed species, which is defined as habitat that is essential for the species' recovery. The Potomac River was proposed for designation as a critical habitat river for the Atlantic sturgeon Chesapeake Bay distinct population segment on June 3, 2016; see 81 Fed. Reg. No. 107, pg. 36078 (June. 3, 2016) and finalized on August 17, 2017; see 82 Fed. Reg. No. 39160, pg. 39160-39274. Critical habitat for the Atlantic Sturgeon was designated on the Potomac River from the Little Falls Dam in Maryland downstream through DC and Virginia to where the main stem river dischargers at its mouth into the Chesapeake Bay (Figure 2). This habitat is designated so as to support Atlantic sturgeon foraging and spawning behaviors.

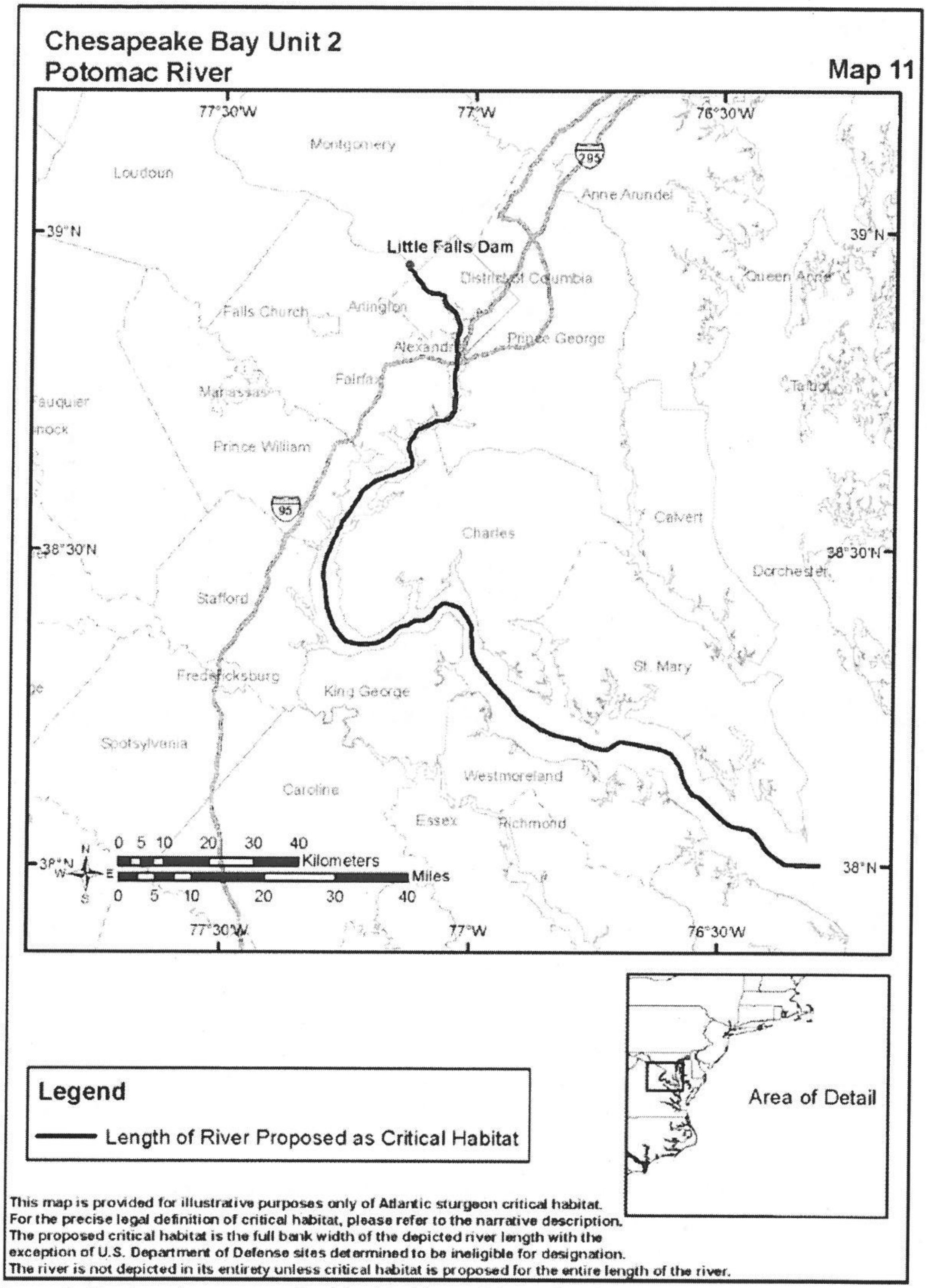

Figure 2: Depicts the proposed critical habitat of the Atlantic Sturgeon in the Potomac River

Figure 3 depicts the estimated range of Atlantic Sturgeon distinct populations (original map was cropped to more accurately depict the action area).

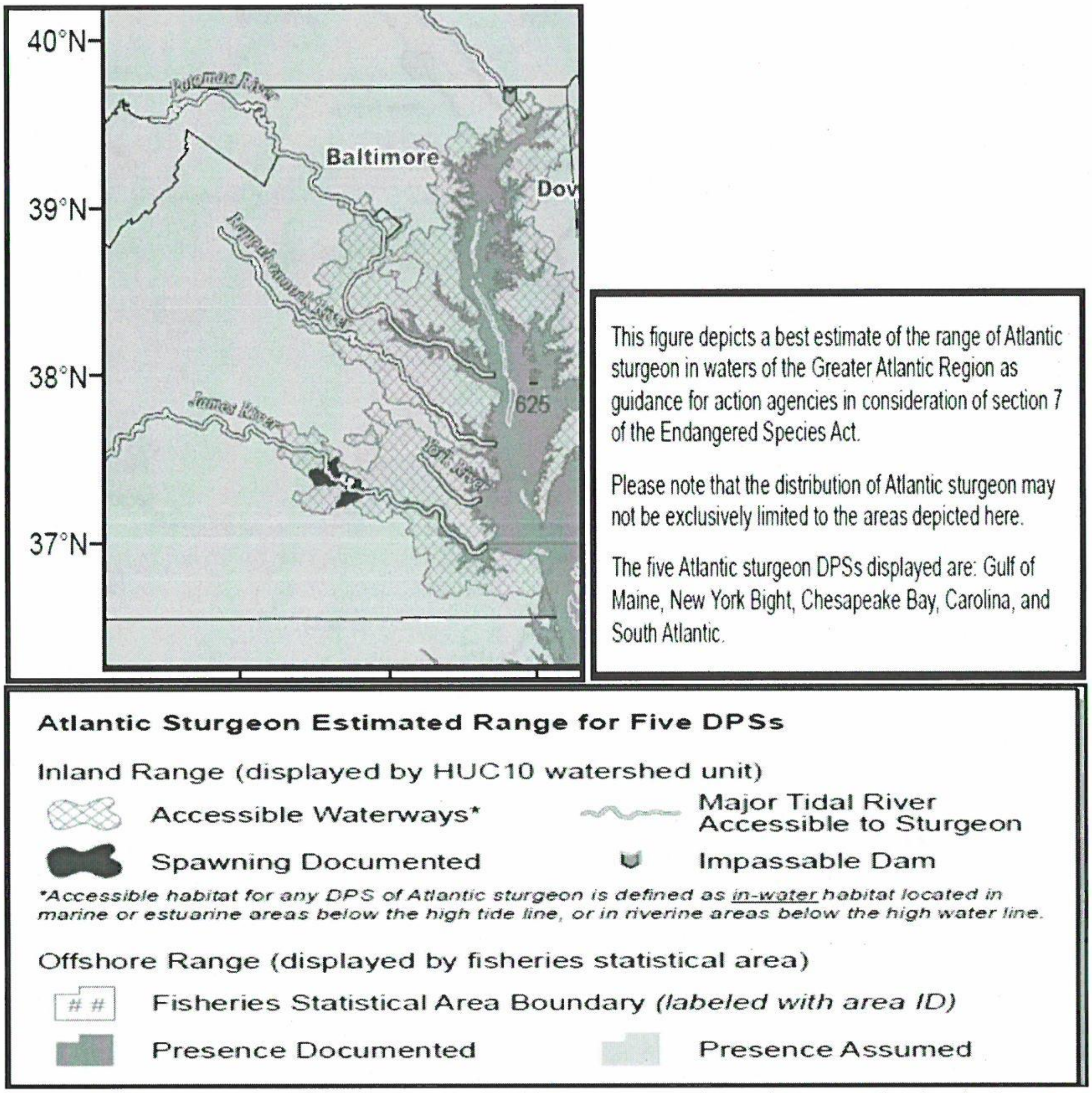

Figure 3: A- Zoomed in piece of map provided by NOAA, Estimated Range of Atlantic Sturgeon DPSs

NMFS suggests that the Chesapeake Bay distinct population is endangered due to protracted population decline, limited spawning and continued impacts and threats. These threats include dredging, water quality degradation (e.g., runoff from agriculture, industrialization and dams), vessel strikes and catching by fisheries.

The final rule designates the critical habitat and defines and describes the habitat and its essential features for Atlantic Sturgeon as follows:

- Hard bottom substrate for settlement of fertilized eggs, refuge, growth, and development of early life stages.
- Aquatic habitat with a gradual downstream salinity gradient of 0.5 to 30 parts per thousand and soft substrate downstream of spawning sites for juvenile foraging and physiological development.
- Water of appropriate depth and absent physical barriers to passage between the river mouth and spawning sites necessary to support (1) unimpeded movement of adults to and from spawning sites, (2) seasonal and physiologically dependent movement of juvenile Atlantic sturgeon to appropriate salinity zones within the river estuary, and (3) staging, resting, or holding of subadults or spawning condition adults. Water depths in main river channels must also be deep enough to ensure continuous flow in the main channel at all times when any sturgeon life stage would be in the river.
- Water, especially in the bottom meter of the water column, with temperature, salinity, and oxygen values that, combined, support (1) spawning, (2) annual and interannual adult, subadult, larval, and juvenile survival, and (3) larval, juvenile, and subadult growth, development, and recruitment.

The Nature Conservancy conducted a project that synthesized available literature, data and models describing distribution and habitat suitability for Atlantic sturgeon in the Delaware River and used that information as a basis for recommended habitat conditions (Moberg and DeLucia 2016). They recommend the following water quality characteristics in order to support successful Atlantic sturgeon recruitment:

- Instantaneous Dissolved Oxygen ≥ 5.0 mg/L
- Temperature < 28° Celsius
- Salinity < 0.5 ppt and
- Discharge > July Q85 (4,000 cfs @ Ben Franklin), when average daily Dissolved Oxygen < 5.5 mg/L

Even though the project specifies the Delaware River, it can be assumed that these characteristics for species survival would also be applicable in the Potomac River.

Effects Determination

Species that may be affected by the proposed action are first assessed to determine if an individual of the listed species population is potentially affected, conservatively assuming that the pollutant is at the criterion magnitude. An acute or chronic minimum effect threshold concentration for each listed species, represented as an SMAV or SMCV, is identified or estimated and compared to the magnitude of the water quality criterion in the state WQS. The methods used to calculate minimum effect thresholds and the final acute and chronic criteria are further described in "*The Ammonia Criteria*" and "*The Cadmium Criteria*" sections of this report. Consistent with the 1985 Guidelines, acute minimum effect thresholds will be divided by an adjustment factor of two to represent a minimum effect threshold concentration not anticipated to result in unacceptable adverse acute effects (Stephan et al., 1985). If a minimum effect threshold is not available for the listed species, a surrogate species that is most closely related to the listed species will be used. Considering surrogate toxicity data at the most phylogenetically-related taxonomic level possible accounts for genetic traits conserved across taxa that influence sensitivity to a pollutant. Minimum effect thresholds are found within EPA's 304(a) recommended criteria documents for ammonia and cadmium for a variety of species. If the chronic or half of the acute minimum effect threshold concentration for a listed or surrogate species is greater than the acute or chronic criterion magnitude under conservatism assumptions, then there is no need to consider criterion duration or frequency. If the chronic or half of the acute minimum effect threshold concentration for a listed species is less than the acute or chronic criterion magnitude, then species are further evaluated to consider time-to-effect data to understand species sensitivity under exposures scenarios consistent with criterion magnitude and duration. Indirect effects are then assessed prior to making a final effects determination. Finally, designated critical habitat in the action area are assessed to determine if the proposed action is likely or not likely to adversely affect critical habitats.

Ammonia Criteria and Toxicity

As described in "*The Ammonia Criteria*" section of this report, freshwater mollusks, and particularly unionid mussels, are particularly sensitive to both chronic and acute exposure to ammonia as compared to other aquatic species. Consequently, the criteria are protective of these sensitive species found in DC.

For the recommended ammonia criteria, EPA analyzed all available and scientifically valid toxicity data and developed both the acute and chronic criteria to be protective of the most sensitive species observed, as shown by the GMAVs and GMCVs displayed below. As per the 1985 Guidelines, whenever there are 59 or more GMAVs in the acute criteria dataset, the FAV is calculated using the four GMAVs closest to the 5th percentile of the distribution, all of which are mussels. The associated GMAVs are listed below in mg TAN/L:

1. *Lasmigona subviridis*, Green Floater (GMAV= 23.41)
2. *Epioblasma capsaeformis*, Oyster mussel (GMAV= 31.14)
3. *Villosa iris*, Rainbow Mussel (GMAV= 34.23)
4. *Lampsilis* sp. (GMAV=46.63)

The FAV was divided by two to calculate the acute criterion of 17 mg TAN/L.

The chronic criteria are calculated using the four most sensitive species, including three mussels and one fish. The associated GMCVs are listed below in mg TAN/L:

1. *Lampsilis* spp, Wavy-rayed lamp mussel and Fatmucket (GMCV=2.126)
2. *Villosa iris*, Rainbow mussel (GMCV= 3.501)
3. *Lepomis* spp., Bluegill and Green sunfish (GMCV= 6.920)
4. *Musculium transversum*, Long fingernailclam (GMCV= 7.547)

The FCV is used as the chronic criterion and is calculated as 1.9 mg TAN/L.

Relative to Shortnose Sturgeon

The acute criteria are determined to be protective of shortnose sturgeon based on the available SMAV for the species. The SMAV for shortnose sturgeon is 156.7 mg TAN/L. The SMAV divided by two (78.35), which represents a minimum effect threshold concentration not anticipated to result in unacceptable adverse acute effects, is over four times higher than the acute criterion (17 mg TAN/L); therefore, EPA has determined that the acute criteria are protective of shortnose sturgeon. As compared to other genera, shortnose sturgeon are ranked at 43 for toxicity to ammonia and are not determined to be particularly sensitive to ammonia.

The chronic criteria are determined to be protective of the shortnose sturgeon based on available data from several surrogate fish species. Chronic ammonia toxicity data are not available for a species within the same family as shortnose sturgeon. To compensate, GMCVs for all fish species are considered. The GMCVs for fish range from 6.920 mg TAN/L for the most sensitive (*Lepomis* sp.) and 21.36 mg TAN/L for the least sensitive (channel catfish), while the chronic criterion is calculated as 1.9 mg TAN/L. Consequently, EPA determined that the chronic criteria are protective of shortnose sturgeon. Based on acute toxicity and when compared to other genera, the shortnose sturgeon is less sensitive to ammonia as compared to other fish and it is expected that shortnose sturgeon are similarly less sensitive to chronic ammonia exposure.

Relative to Atlantic Sturgeon

The acute criteria are determined to be protective of Atlantic sturgeon based on the available data for the surrogate species, shortnose sturgeon, found within the same genus, *Acipenser*. The SMAV for shortnose sturgeon is 156.7 mg TAN/L. The SMAV divided by two (78.35), which represents a minimum effect threshold concentration not anticipated to result in unacceptable adverse acute effects, is over four times higher than the acute criterion (17 mg TAN/L); therefore, EPA has determined that the acute criteria are protective of sturgeon. As compared to other genera, shortnose sturgeon are ranked at 43 for toxicity to ammonia and are not determined to be particularly sensitive to ammonia. Based on data available for the surrogate species, EPA determined that the acute criteria are protective of the Atlantic sturgeon.

The chronic criteria are determined to be protective of the Atlantic sturgeon based on available data from several surrogate fish species. Chronic ammonia toxicity data are not available for a species within the same family as Atlantic sturgeon. To compensate, GMCVs for all fish species are considered. The GMCVs for fish range from 6.920 mg TAN/L for the most sensitive (*Lepomis* sp.) and 21.36 mg TAN/L for the least sensitive (channel catfish), while the chronic criterion is calculated as 1.9 mg TAN/L. Consequently, the chronic ammonia criteria are deemed protective of Atlantic sturgeon. Based on acute toxicity and when compared to other genera, sturgeon are less sensitive to ammonia as compared to other fish; therefore, it is expected that Atlantic sturgeon are also less sensitive to chronic ammonia exposure.

Cadmium Criteria and Toxicity

According to EPA research, fish, and particularly those in the *Oncorhynchus* genus, tend to be more sensitive to both acute and chronic exposure to cadmium as compared to other aquatic organisms. For example, the most sensitive fish genus is represented by a GMAV of 4.190 µg/L, while the most sensitive invertebrate genus is represented by a GMAV of 23.00 µg/L. Consequently, the acute and chronic criteria are protective of these sensitive species.

For the recommended cadmium criteria, EPA analyzed all available and scientifically valid toxicity data and developed both the acute and chronic criteria to be protective of the most sensitive species observed, as shown by the GMAV and GMCV displayed below. As per the 1985 Guidelines, whenever there are 59 or more GMAVs in the acute criteria dataset, the FAV is calculated using the four GMAVs closest to the 5th percentile of the distribution, all of which are fish. The associated GMAVs are listed below in µg/L of total Cd:

1. *Cottus* (GMAV= 4.411)
2. *Salmno trutta*, Brown trout (GMAV= 5.642)
3. *Morone saxatilis*, Striped bass (GMAV= 5.931)
4. *Oncorhynchus* (GMAV=6.141)

The final criterion is more stringent than the FAV resultant from the regression analysis because another FAV was chosen to protect the commercially important rainbow trout, *Oncorhynchus mykiss*. The SMAV (3.727 µg/L) for the rainbow trout is below the GMAV for the most sensitive genera and was used as the FAV. To protect the rainbow trout, the FAV was divided by two to calculate the acute criterion of 1.8 µg/L of Cd.

The chronic criteria are calculated using the most sensitive species, including three invertebrates and one fish. The associated GMCVs are listed below in µg/L of Cd:

1. *Hyalella azteca*, Amphipod (GMCV= 0.7453)
2. *Ceriodaphnia*, Cladoceran (GMCV= 1.293)
3. *Cottus bairdii*, Mottled sculpin (GMCV= 1.470)
4. *Chironomus dilutus*, Midge (GMCV= 2.000)

The FCV is used as the chronic criterion and is calculated as 0.72 µg/L of Cd.

Relative to Shortnose Sturgeon

The acute criteria are determined to be protective of shortnose sturgeon based on the available data for the surrogate species, White sturgeon, found within the same genus, *Acipenser*. The SMAV for White sturgeon is 33.78 µg/L. The SMAV divided by two (16.89), which represents a minimum effect threshold concentration not anticipated to result in unacceptable adverse acute effects, is over nine times higher than the acute criterion (1.8 mg µg/L); therefore, EPA has determined that the acute criteria are protective of sturgeon. As compared to other genera, sturgeon are ranked at 8 for toxicity to cadmium and are not determined to be particularly sensitive to cadmium. Therefore, with White sturgeon as a surrogate species, EPA determined that the effects of the acute criteria for cadmium on shortnose stugeron are extremely unlikely to occur and discountable.

The chronic criteria for cadmium are determined to be protective of shortnose sturgeon based on available data from several surrogate fish species. Chronic cadmium toxicity data are not available for a species within the same family as shortnose sturgeon. To compensate, GMCVs for all fish species are considered. The GMCVs for fish range from 1.470 µg/L for the most sensitive (mottled sculpin) and 38.66 µg/L for the least sensitive (blue tilapia), while the chronic criterion is calculated as 0.72 µg/L. Based on acute toxicity and when compared to other genera, sturgeon are less sensitive to cadmium as compared to other fish; therefore, it is expected that shortnose sturgeon are also less sensitive to chronic ammonia exposure. Consequently, EPA determined that the effects of the chronic criteria for cadmium on shortnose stugeron are extremely unlikely to occur and discountable.

Relative to Atlantic Sturgeon

The acute criteria are determined to be protective of Atlantic sturgeon based on the available data for the surrogate species, White sturgeon, found within the same genus, *Acipenser*. The SMAV for White sturgeon is 33.78 µg/L. The SMAV divided by two (16.89), which represents a minimum effect threshold concentration not anticipated to result in unacceptable adverse acute effects, is over nine times higher than the acute criterion (1.8 mg µg/L); therefore, EPA has determined that the acute criteria are protective of sturgeon exposure to . As compared to other genera, sturgeon are ranked at 8 for toxicity to cadmium and are not determined to be particularly sensitive to cadmium. Therefore, with White sturgeon as a surrogate species, EPA determined that the effects of the acute criteria for cadmium on Atlantic sturgeon are extremely unlikely to occur and discountable.

The chronic criteria for cadmium are determined to be protective of Atlantic sturgeon based on available data from several surrogate fish species. Chronic cadmium toxicity data are not available for a species within the same family as Atlantic sturgeon. To compensate, GMCVs for all fish species are considered. The GMCVs for fish range from 1.470 µg/L for the most sensitive (mottled sculpin) and 38.66 µg/L for the least sensitive (blue tilapia), while the chronic criterion is calculated as 0.72 µg/L. Based on acute toxicity and when compared to other genera, sturgeon are less sensitive to cadmium as compared to other fish; therefore, it is expected that Atlantic sturgeon are also less sensitive to chronic ammonia exposure. Consequently, EPA determined that the effects of the chronic criteria for cadmium on Atlantic sturgeon are extremely unlikely to occur and discountable.

Additionally, EPA evaluated possible indirect effects of the ammonia and cadmium criteria on prey species abundance. Because EPA's 304(a) recommended criteria are developed to be protective of a vast array of aquatic life, including macro-invertebrates and mollusks prey species of sturgeon, EPA determined that the effects of the ammonia and cadmium criteria on listed species' prey abundance are too small to be detected and therefore insignificant. Therefore, EPA's approval of DC's ammonia and cadmium criteria are not likely to adversely affect the quality and/or availability of food for the listed species. Furthermore, as stated in EPA's criteria documents, concerns of bioaccumulation of ammonia and cadmium in prey species for the listed sturgeons were addressed in criteria development. Exposure through water represent the most toxic pathways for aquatic organisms for both ammonia and cadmium.

Effects Determination Summary: Listed Species

Based on the above analyses, EPA determined that the federal action to approve DC's aquatic life criteria for ammonia and cadmium is not likely to adversely affect the listed species that occur within the action area. DC adopted EPA's recommended criteria for ammonia and cadmium, which went through robust scientific review and analysis using rigorous and up-to-date toxicity data. The effects of the acute and chronic water quality criteria magnitude for both ammonia and cadmium on the shortnose sturgeon and Atlantic sturgeon are extremely unlikely to occur and are therefore discountable. Furthermore, indirect effects of the ammonia and cadmium criteria on the listed species are too small to be detected and therefore insignificant.

Critical Habitat Assessment

The ESA authorizes USFWS and NMFS to designate critical habitat for federally-listed species, which is defined as habitat that is essential for the species' recovery. On June 2, 2016, NOAA announced proposed rules to designate critical habitat for five distinct population segments of federally listed Atlantic sturgeon (See 81 Fed. Reg. No. 107, pg. 36078-36123; June 3, 2016) and took additional public comments for the proposed critical habitat of the Atlantic sturgeon from September 29, 2016 until October 14, 2016 (See 81 Fed. Reg. No. 189, pg. 66911-12; Sept. 29, 2016); this included the Chesapeake Bay distinct population. Critical habitat designation for the Atlantic sturgeon was published in the Federal Register on August 17th, 2017 (See 82 Fed. Reg. No. 158, pg. 39160-38274). The Potomac River was designated as a critical habitat river for the Atlantic sturgeon Chesapeake Bay distinct population segment on August 17, 2017. Critical habitat for the Atlantic Sturgeon was proposed on the Potomac River from the Little Falls Dam in Maryland downstream through DC and Virginia to where the main stem river dischargers at its mouth into the Chesapeake Bay (Figure 2). This habitat is designated so as to support Atlantic sturgeon foraging and spawning behaviors.

NOAA identifies a key objective for the Chesapeake Bay DPS is to increase the abundance of each DPS by facilitating increased successful reproduction and recruitment to the marine environment. The Physical or biological features (PBFs) that require special management considerations concerning any proposed action in the proposed critical habitat for the Atlantic sturgeon are discussed below. PBFs considered present within this action area are outlined below.

1. *Hard bottom substrate (*(e.g. rock, cobble, gravel, limestone, boulder etc...) in low salinity waters (0.0-0.5 ppt) to allow for settlement of fertilized eggs, refuge, growth, and development of early life stages.*
   The revisions to the ammonia and cadmium criteria focus solely on the allowable levels of those pollutants throughout D.C. waters. Waters with ammonia and/or cadmium at or under the magnitude of the criteria would have no effect on actual hard bottom substrate, nor would they shift salinity levels in waters of D.C. that may possess this PBF. Therefore, there would also be no effects of the criteria on the settlement of fertilized eggs, refuge, growth, and development of early life stages.

2. *Aquatic habitat with a gradual downstream salinity gradient of 0.5 to 30 parts per thousand with soft substrate (e.g. sand, mud) between the river mouth and spawning sites for juvenile foraging and physiological development.*
   The revisions to the ammonia and cadmium criteria focus solely on the allowable levels of those pollutants throughout D.C. waters. Waters with ammonia and/or cadmium at or under the magnitude of the criteria would have no effect on aquatic habitat with a gradual downstream salinity gradient of 0.5 to 30 parts per thousand with soft substrate between the river mouth and spawning sites for juvenile foraging and physiological development.

3. *Appropriate water depth and absent physical barriers to passage (e.g. locks, dams, thermal plumes, turbidity, sound, reservoirs, gear etc.) between the river mouth and spawning sites necessary to support unimpeded movement of adults to and from spawning sites, seasonal and physiologically dependent movement of juvenile Atlantic sturgeon to appropriate salinity zones within the river estuary and staging, resting or holding of subadults or spawning condition adults. Water depths must be deep enough (at least 1.2 m) to ensure continuous flow in the main channel at all times when any sturgeon life stage would be in the river.*
   The revisions to the ammonia and cadmium criteria focus solely on the allowable levels of those pollutants throughout D.C. waters. The effects of the criteria on appropriate water depth and physical barriers to passage to support unimpeded movement of adults to and from spawning sites, seasonal and physiologically dependent movement of juvenile Atlantic sturgeon to appropriate salinity zones within the river estuary and staging, and resting or holding of subadults or spawning condition adults are too small to be detected and therefore insignificant. Because the water quality criteria have been set at a level that is not likely to adversely affect the listed species, any waters with ammonia or cadmium at or below the criteria magnitude would have effects that are too small to be detected as they are set at appropriate levels for the species, and all effects would be insignificant.

4. *Water between the river mouth and spawning sites, especially in the bottom meter of the water column, with temperature, salinity, and oxygen values that, combined, support spawning, annual and interannual adult, subadult, larval and juvenile survival; larval, juvenile and subadult growth, development and recruitment (e.g. 13-26°C for spawning habitat and no more than 30°C for juvenile rearing habitat and 6.0 mg/L DO or greater for juvenile rearing habitat).*
   The revisions to the ammonia and cadmium criteria focus solely on the allowable levels of those pollutants throughout D.C. waters. Waters with ammonia and/or cadmium at or under the magnitude of the criteria would have no effect on temperature, salinity, and oxygen values between the river mouth and spawning sites, especially in the bottom meter of the water column, that, combined, support spawning, annual and interannual adult, subadult, larval and juvenile survival; larval, juvenile and subadult growth, development and recruitment.

To determine whether EPA's approval of DC water quality criteria for ammonia and cadmium is likely to adversely affect critical habitat, EPA evaluated the effects of ammonia and cadmium relative to the essential features of habitat. In evaluating the effects of the action on critical habitat, EPA concluded that the essential features of the critical habitat relate to physical structures of the river such as water depth, substrate composition, barriers to passage, water velocity, instream cover, etc. as well as dissolved oxygen and salinity, will not be adversely affected by the ammonia and cadmium criteria approval. There are no effects of the proposed action on PBFs 1, 2, and 4; while the effects of the proposed criteria on PBF 3 are too small to be detected and therefore insignificant. Additionally, the proposed criteria will not affect the sound, habitat structure and disturbance, dredging, water quality (turbidity), in-water structures, prey quality/quantity, or vessel traffic for any of the listed species.

Final Effects Determination: Critical Habitat

As required by Section 7 of the ESA and the implementing regulations at 50 C.F.R. Part 226, EPA has used the best available scientific data to determine whether the action is likely to "destroy or adversely modify the designated critical habitat of the listed species". The above analysis indicates EPA's approval of DC's water quality criteria for ammonia and cadmium are not likely to adversely affect critical habitat of the Atlantic sturgeon located within the action area in the Potomac River due to those effects on PBF 3 being too small to be detected and therefore insignificant. The primary constituent elements of the critical habitat likely will not be altered or destroyed to the extent that the survival and recovery of the species would be appreciably reduced. Consequently, these effects are not likely to adversely affect the conservation role of the critical habitat or "result in significant adverse effects throughout the species' range or appreciably diminish the capability of the critical habitat to satisfy essential requirements of the species".

Conclusion

EPA's analysis indicates that the approval of the freshwater ammonia and cadmium water quality criteria for the protection of aquatic life is insignificant and/or discountable and may affect, but is not likely to adversely affect, the proposed, threatened and endangered species in DC under NMFS' jurisdiction. Additionally, EPA also concludes that the ammonia and cadmium water quality criteria revisions are not likely to adversely affect critical habitat of the Atlantic sturgeon designated under NMFS' jurisdiction. EPA certifies that the best scientific and commercial data available were used to complete this analysis. EPA requests your concurrence with this determination.

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